MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2019 / 2020

PEL0016 - ELECTRICITY AND MAGNETISM

(Foundation in Engineering)

17 OCTOBER 2019
2.30 p.m. – 4.30 p.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of **FOUR (4)** printed pages excluding the cover page and appendices, with **FOUR (4)** questions.

2. Answer **ALL** questions. The distribution of the marks for each question is given.

3. Please write all your answers in the Answer Booklet provided.

QUESTION 1 (15 marks)

a) A electron is moving in a 3 cm radius circular path due to the present of a magnetic field, $B = 5 \times 10^{-3}$ T. Calculate the velocity of the electron. [4 marks]

b) Two parallel wires are 3 cm apart. Each wire carries 10 A flowing in the same direction. Calculate:
   i) the magnetic field, B at a distance of 3 cm from the wire. [2 marks]
   ii) the net magnetic field at the center of a straight line connecting both the wires. [6 marks]

c) A 20 cm long solenoid has 800 turns of wire. Calculate the current needed to generate a magnetic field, B = 0.4 T. [3 marks]

QUESTION 2 (15 marks)

Calculate I_1, I_2 and I_3 using Kirchhoff's Laws for the circuit in **Figure Q2**. [3 × 5 marks]

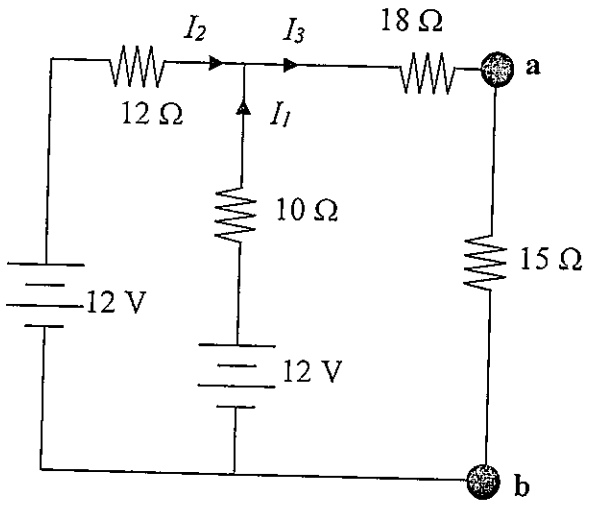

Figure Q2

QUESTION 3 (10 marks)

a) The output of an audio amplifier is capable of delivering an average output of 100 W into an 8 Ω speaker. Calculate:
   i) the rms voltage [2 marks]
   ii) the rms current [2 marks]

b) A 5 Ω resistor, a 0.5 mH inductance, and a 0.5 μF capacitance in connected in series. The circuit is to operate at 60.0 Hz. Calculate the impedance:
   i) resistor, R in series with capacitor C [3 marks]
   ii) capacitor, C in series with inductor, L [3 marks]

Continued...

QUESTION 4 (10 marks)

a) Explain the following with respect to number of carriers:
   i) Intrinsic semiconductor [2 marks]
   ii) Extrinsic semiconductor [2 marks]

b) **Figure Q4 (b)** shows a full bridge rectifier circuit.
   i) A sinusoidal AC is supply to the input. Explain the flow of current by describing which particular diode (D1, D2, D3, D4) it pass through to obtain full bridge rectification. [3 marks]
   ii) Sketch the rectified output with respect to the input. [3 marks]

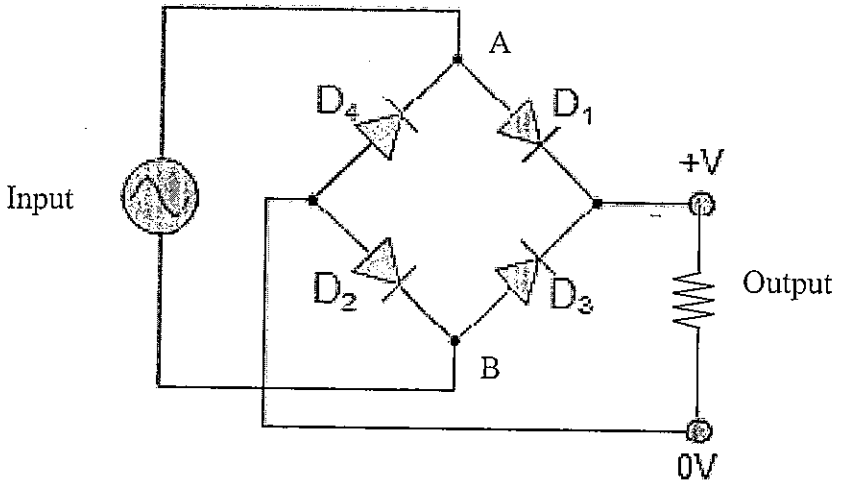

Figure Q4 (b)

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APPENDIX 1

Physical Constants

Quantity	Symbol	Value
Electron mass	m_e	9.11×10^{-31} kg
Proton mass,	m_p	1.67×10^{-27} kg
Elementary charge	e	1.602×10^{-19} C
Gravitational constant	G	6.67×10^{-11} Nm^2kg^{-2}
Gas constant	R	8.314 $J(K.mol)^{-1}$
Hydrogen ground state	E_o	-13.6 eV
Boltzmann's constant	k_B	1.38×10^{-23} JK^{-1}
Compton wavelength	λ_c	2.426×10^{-12} m
Planck's constant	h	6.626×10^{-34} J.s
Speed of light in vacuum	c	3.0×10^{8} ms^{-1}
Rydberg constant	R_H	1.097×10^{7} m^{-1}
Acceleration due to gravity,	g	9.81 ms^{-2}
Atomic mass unit (1u)	u	1.66×10^{-27} kg
Avogadro's number	N_A	6.023×10^{23} mol^{-1}
Threshold of intensity of hearing	I_o	1.0×10^{-12} Wm^{-2}
Coulomb constant	k	8.988×10^{9} Nm^2C^{-2}
Permittivity of free space	ε_o/κ_o	8.85×10^{-12} $C^2(N.m^{-2})$
Permeability of free space	μ_o	$4\pi \times 10^{-7}$ Hm^{-1}

Energy equivalent of atomic mass unit:

One atomic mass unit (1.0 u) is equivalent to 931.5 MeV

APPENDIX II

List of formulas

$$A_v = \frac{V_c}{V_b}$$

$$\alpha_{dc} = \frac{\beta_{dc}}{\beta_{dc}+1}$$

$$\beta_{dc} = \frac{\alpha_{dc}}{1-\alpha_{dc}}$$

$$B = \frac{\mu_0 I}{2\pi r}$$

$$B = \mu_0 nI$$

$$\xi = V + Ir$$

$$\xi = blv$$

$$\xi = -N\frac{\Delta\Phi}{\Delta t}$$

$$\xi = -L\frac{dI}{dt}$$

$$\xi = -M\frac{dI}{dt}$$

$$F = BIL\sin\theta$$

$$F = qvB\sin\theta$$

$$\frac{F}{\ell} = \frac{\mu_0 I_1 I_2}{2\pi d}$$

$$f_r = \frac{1}{2\pi\sqrt{LC}}$$

$$I_{tot} = \sqrt{I_R^2 + (I_L - I_C)^2}$$

$$I = neA(v_n + v_p)$$

$$I = nev_d A$$

$$I = I_{max}\sin\omega t$$

$$I_{rms} = \frac{I_{max}}{\sqrt{2}}$$

$$I_x = \left(\frac{R_T}{R_x}\right)I_T$$

$$L = \frac{N\Phi_B}{I}$$

$$L = \frac{\mu_o N^2 A}{l}$$

$$M = \frac{N\Phi_B}{I}$$

$$M = \frac{\mu_o N_1 N_2 A}{l}$$

$$P = IV = I^2R = \frac{V^2}{R}$$

$$P_t = I_{rms}V_{rms}\cos\phi$$

$$P_r = V_{rms}I_{rms}\sin\phi$$

$$P_a = I_{rms}^2 Z$$

$$R = \frac{\rho L}{A}$$

$$R = R_0\left[1+\alpha\left(T-T_0\right)\right]$$

$$R_T = R_1 + R_2 + R_3 + \ldots$$

$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \ldots$$

$$r = \frac{mv}{Bq}$$

$$\tau = NBIA\sin\theta$$

$$U = \frac{1}{2}LI^2$$

$$U = \frac{1}{2}B^2 A\frac{l}{\mu_o}$$

$$V_H = Bvd$$

$$V = V_{max}\sin\omega t$$

$$V_{rms} = \frac{V_{max}}{\sqrt{2}}$$

$$V_x = \left(\frac{R_x}{R_T}\right)V_S$$

$$X_C = \frac{1}{2\pi fC}$$

$$X_L = 2\pi f L$$

$$Z = \sqrt{R^2 + (X_L - X_C)^2}$$

$$\oint B.dl = \mu_o I$$

$$d\mathbf{B} = \frac{\mu_O I}{4\pi}\frac{d\ell\times\hat{\mathbf{r}}}{r^2}$$

$$\Phi_B = BA\cos\theta$$

$$\cos\phi = \frac{R}{Z}$$

$$\tan\phi = \frac{X_L - X_C}{R}$$